Refine Search

Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Search Results -

Terms	Documents
L29 and (chart$ or graph$ or curv$)	3

Database: US Pre-Grant Publication Full-Text Database; US Patents Full-Text Database; US OCR Full-Text Database; EPO Abstracts Database; JPO Abstracts Database; Derwent World Patents Index; IBM Technical Disclosure Bulletins

Search: L32

Refine Search | Recall Text | Clear | Interrupt

Search History

DATE: Monday, April 25, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR			
L32	L29 and (chart$ or graph$ or curv$)	3	L32
L31	L11 and (leav$ with (servic$ or repair$))	0	L31
L30	L29 not l26	6	L30
L29	L10 and (leav$ with (servic$ or repair$))	6	L29
L28	L26 and (leav$ with (servic$ or repair$))	0	L28
L27	L26 and (leave with (service or repair$))	0	L27
L26	L25 and provider	1	L26
L25	L23 and l22	1	L25
L24	L23 or l22	1	L24
L23	L22 and (internet or www$ or web$ or online)	1	L23

L22	L21 and (service and (quer$ or question$))	1	L22
L21	L20 not l19	13	L21
L20	L10 and signature$	13	L20
L19	L17 and sign$	4	L19
L18	L17 and signatur$	0	L18
L17	L16 and (visual$ or sens$)	4	L17
L16	L15 and (chart$ or graph$ or curv$)	9	L16
L15	L14 and obd$	10	L15
L14	L13 and remote$	22	L14
L13	L12 and record$	29	L13
L12	L11 and (service and (quer$ or question$))	40	L12
L11	L10 and (internet or www$ or web$ or online)	83	L11
L10	L9 and @ad<=20011012	386	L10
L9	L8 and l7	571	L9
L8	701/29-31,35.ccls.	2206	L8
L7	memory and (obd$ or diagnost$) and (vehicle or automobile)	13537	L7
DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR			
L6	L4 and (internet or www$ or web$ or online)	1	L6
L5	L4 and (obd$ or diagnost$)	2	L5
L4	L1 or l2	2	L4
L3	l1 and (quer$ or question$)	1	L3
L2	6574603.pn.	1	L2
L1	5341291.pn.	1	L1

END OF SEARCH HISTORY

Hit List

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 6 of 6 returned.

☐ 1. Document ID: US 6615160 B1

Using default format because multiple data bases are involved.

L29: Entry 1 of 6 File: USPT Sep 2, 2003

US-PAT-NO: 6615160
DOCUMENT-IDENTIFIER: US 6615160 B1
** See image for Certificate of Correction **

TITLE: Methods and apparatus for engine diagnostics

DATE-ISSUED: September 2, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Quinnett; Wilbur V.	Fond du Lac	WI		
Koerner; Scott A.	Kenosha	WI		
Szukala; Lester M.	Ingleside	IL		
Dylsma; Phillip J.	Brookfield	WI		

US-CL-CURRENT: 702/185; 123/361, 123/363, 701/29, 701/35

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 2. Document ID: US 6212449 B1

L29: Entry 2 of 6 File: USPT Apr 3, 2001

US-PAT-NO: 6212449
DOCUMENT-IDENTIFIER: US 6212449 B1

TITLE: Diagnosing malfunctions in materials handling vehicles

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 3. Document ID: US 5781125 A

L29: Entry 3 of 6 File: USPT Jul 14, 1998

US-PAT-NO: 5781125
DOCUMENT-IDENTIFIER: US 5781125 A

TITLE: Arrangement for the wireless exchange of data between a servicing device and a control unit in a motor vehicle

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 4. Document ID: US 5453939 A

L29: Entry 4 of 6 File: USPT Sep 26, 1995

US-PAT-NO: 5453939
DOCUMENT-IDENTIFIER: US 5453939 A

TITLE: Computerized diagnostic and monitoring system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 5. Document ID: US 5214582 A

L29: Entry 5 of 6 File: USPT May 25, 1993

US-PAT-NO: 5214582
DOCUMENT-IDENTIFIER: US 5214582 A
** See image for Reexamination Certificate **

TITLE: Interactive diagnostic system for an automotive vehicle, and method

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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☐ 6. Document ID: US 5058044 A

L29: Entry 6 of 6 File: USPT Oct 15, 1991

US-PAT-NO: 5058044
DOCUMENT-IDENTIFIER: US 5058044 A

TITLE: Automated maintenance checking system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw De

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Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L10 and (leav$ with (servic$ or repair$))	6

Display Format: - Change Format

L29: Entry 6 of 6 File: USPT Oct 15, 1991

DOCUMENT-IDENTIFIER: US 5058044 A
TITLE: Automated maintenance checking system

Abstract Text (1):
A system for automatically identifying vehicles, assimilating data from an identified vehicle, correlating the data with predetermined data and providing a statement of account indicative of a transaction involving the vehicle. The system also provides a service record of the vehicle for use in connection with the transaction. For example, in a car rental environment, the service report is utilized by an attendant to determine if such service items as refilling the fuel tank are necessary. Primarily, data for the service record is provided by sensors located on-board the vehicle. The sensor data may be supplemented by data inputted via a keyboard located on-board the vehicle.

Application Filing Date (1):
19890330

Brief Summary Text (2):
The invention generally relates to systems for processing vehicle information and in particular to a system for automating maintenance routines and transactions related thereto.

Brief Summary Text (4):
Available systems for maintenance of passenger vehicles typically require maintenance records to be manually updated. In this regard, an operator of a passenger vehicle is typically required to verbally communicate to a mechanic the maintenance needs of the vehicle for even the simplest of jobs. For example, in a commercial vehicle repair operation, passenger vehicles are usually dropped off at a service site where the operator of the vehicle verbally describes the needed maintenance or a malfunctioning condition before leaving the vehicle at the site for servicing. In a car rental system, a returned vehicle is visually inspected for damage beyond normal wear resulting from the rental. Many problems are not immediately apparent from a visual inspection. When the symptoms of these problems are noticed, the vehicle may have been returned to service and, therefore, the source of the damage cannot be determined. Also, routine maintenance of a rental vehicle is typically performed after it has been returned from service and before it is placed back into the rental fleet. This routine maintenance also requires a visual inspection of the vehicle in order to ensure devices such as head and taillights are properly functioning.

Brief Summary Text (5):
Some suggestions have been made in the past to employ available technology for the purpose of automating transactions concerning vehicles. For example, U.S. Pat. No. 4,398,172 to Carroll, et al. suggests that a system for interrogating memories on-board vehicles may be used to create an automatic billing system in a car rental environment. Applicants are not aware, however, of a system providing for the full automation of a vehicle transaction, including the routine record keeping associated with the complete maintenance of a vehicle.

Brief Summary Text (7):
It is the general object of the invention to automatically collect data related to the operational history of a vehicle and provide the same in a format useable for a commercial transaction.

Brief Summary Text (8):
It is a related object of the invention to provide a system for accomplishing the foregoing object which may be easily and inexpensively integrated into existing systems used for vehicle-related commercial transactions.

Brief Summary Text (9):
It is another important object of the invention to provide a system for the automatic recording of the operational history of a vehicle for use by a mechanic in determining its maintenance requirements.

Brief Summary Text (10):
It is another object of the invention to provide a system for contemporaneously recording in a machine-readable form the malfunctioning of selected systems and their components in a vehicle.

Brief Summary Text (12):
To achieve the foregoing objects, a system according to the invention includes a processing system on-board a vehicle for gathering data related to the operational history of the vehicle and transferring the data to a stationary processing system for providing information to a mechanic regarding needed repairs and to also provide for the automation of commercial transactions such as the billing of vehicle rentals or of repair work to an owned/leased vehicle. The on-board system includes a processor for collecting data from sensors associated with selected operating systems of the vehicle (e.g., lights, drive train, tires and fluid levels). Depending upon the system monitored, the processor may continually update its condition (e.g., mileage and gas level) in a storage area or it may only store information when service is required (e.g., lights and drive train). When the vehicle enters a service area, the on-board system is interrogated for its stored information. The interrogation is executed by an annunciator system which first detects the physical presence of the vehicle and then transmits an RF interrogation signal to a receiver on-board the vehicle and coupled to the on-board processor. If the interrogation signal is recognized by the on-board processor, a vehicle identification code along with the stored information is converted to an RF signal and transmitted from the vehicle.

Brief Summary Text (13):
Associated with the stationary system is a receiver for receiving and converting the RF signal from the vehicle to a digital format for processing. The identification code received from the vehicle is matched by the stationary system with the same identification code held in a memory. Information stored at the stationary system and associated with the matched identification code is retrieved and processed with information downloaded from the vehicle. In accordance with the invention, the processing of the combined information identifies particular systems and system devices of the vehicle which require maintenance. The information is also processed so as to totally automate any commercial transaction associated with the maintenance. In a preferred embodiment, the invention is applied to a car rental system so as to automate billing and track maintenance needs of each vehicle upon its return from rental service. In an alternative embodiment, applicants contemplate applying the invention to commercial car repair operations such that a car owner/leaseholder can drop off a car at a service location which interrogates the on-board processor and compiles a work order based on the information received from the vehicle and stored at the service location.

Brief Summary Text (14):

In a car rental environment, a vehicle which is returned after rental is driven to a designated site which is marked, for example, by a gate with a stop/go light indicating the vehicle should stop. When the vehicle enters the site, the system senses the presence of the vehicle and responds by transmitting an interrogation signal to the vehicle. When the vehicle receives the interrogation signal it responds by transmitting identification and operating parameter information to the system. After this information is processed, it is verified by the system and if the information is determined to be acceptable, the system sends a signal to the site indicating that the information was properly received. Such a step involves the system sending a control signal to the designated site which opens the gate and changes the condition of the stop/go light to indicate the vehicle may advance. In a preferred embodiment, the system is capable of simultaneously servicing multiple sites such that many vehicles may be processed at the same time.

Brief Summary Text (15):
In addition, to interrogation of a vehicle for the downloading of data, the system of the invention may also be used to program vehicle parameters. For example, parameters such as trip mileage, license plate number or other vehicle identification information or vehicle servicing information may be set or modified in a memory located on-board the vehicle.

Brief Summary Text (16):
Preferably, identification and operating information gathered from the vehicle is processed into a predetermined digital form and made available to a pre-existing main computer system through a standard communications link. By operating in this manner, the system is made easily compatible with pre-existing systems, and is capable of processing information which traditionally has been gathered only through manual methods. Thus, system errors resulting from manual intervention are essentially eliminated, and the time required to gather and process such information is substantially reduced.

Brief Summary Text (17):
Data downloaded from a vehicle is also used to formulate service orders for the vehicle prior to its return to the rental fleet. Downloaded data is analyzed and repair or maintenance orders are generated via a printer and display for use by an attendant. For example, if a vehicle is returned without refilling the fuel tank, the order will indicate the vehicle requires refueling. Other on-board sensors may also provide the basis for maintenance orders-e.g., oil level, window washer shield level and burned-out lamp sensors.

Drawing Description Text (2):
FIG. 1 is a schematic block diagram of a system for processing vehicles in accordance with a preferred embodiment of the invention;

Drawing Description Text (3):
FIG. 2 is a schematic block diagram of an exemplary architecture for the control circuit of FIG. 1 on-board a vehicle to be processed in accordance with the invention;

Drawing Description Text (4):
FIG. 3 is an enlarged plan view of a keyboard for mounting to the dashboard area of a vehicle processed by the system of FIG. 1;

Drawing Description Text (6):
FIG. 5 is a flow diagram of functions executed by electronics on-board a vehicle within the service area in response to interrogation initiated by the low-frequency transmitter and annunciator;

Drawing Description Text (7):
FIG. 6 is a flow diagram of the functions executed by the electronics on-board the

vehicle in response to the recognition of an interrogation signal from the low-frequency transmitter and annunciator located within a service area;

Drawing Description Text (8):
FIG. 7 is a flow diagram of the functions executed by a high-frequency receiver located in a service area and an associated local processor for receiving data downloaded from the electronics on-board a vehicle in a service area;

Detailed Description Text (3):
For the purpose of illustrating an exemplary architecture of a system according to the invention, a vehicle (17), (shown in block form) is located within the area serviced by a first station (10) in FIG. 1. The first station (10) functions as a site for the gathering of information from vehicles entering the area of the station, and it is attached to a local processor (11) via an input port (12). Similarly, second and third stations (13) and (14) are attached to the local processor (11) via input ports (15) and (16), respectively. The local processor (11) is of a conventional microprocessor-type architecture based preferably on a Z-80 microprocessor manufactured by Zilog Corporation. The accompanying memory and interfacing chips are preferably low power CMOS technology, so as to operate properly at a wide temperature range. These chips would include an 8K-byte static RAM memory, serial I/O chips such as NSA-8250A's manufactured by National Semiconductor Corporation, parallel I/O chips such as NSA-8251's manufactured by National Semiconductor Corp. and a 32K-bit PROM such as a 27C32 manufactured by Fujitsu Corp. of Japan. In an alternative arrangement, the local processor system may be a microcomputer system such as an IBM PC or compatible. However, in addition to all the standard elements to such a microcomputer system, when used as a local processor a parallel I/O part is required which provides two-way communications in contrast to conventional parallel ports provided on microcomputer systems which only allow one-way transmittal of information to a printer device.

Detailed Description Text (4):
The presence of the vehicle (17) is detected by an annunciator (18). Preferably, the annunciator (18) is of conventional configuration and may be activated, for example, by a vehicle entering the station (10) and interrupting a light beam which is normally received by an optical detector. Alternatively, the annunciator (18) may be a proximity relay of conventional design which detects the presence of the vehicle (17) when it enters the vicinity of the station. Those familiar with annunciators will realize other conventional devices may also suffice.

Detailed Description Text (5):
Upon detecting the presence of the vehicle (17), the annunciator (18) keys a low-frequency transmitter (19) which transmits a low-frequency directional signal to the vehicle. The vehicle (17) detects this low-frequency signal from a low-frequency receiver (20) located on board the vehicle (17). Upon receipt of the low-frequency signal by the low-frequency receiver (20), a control circuit (23) on-board the vehicle is activated and reads gas and mileage information from gas and mileage sensors (21) and (22) and transmits this and vehicle identification information as an RF signal to a high-frequency receiver (24) via a high-frequency transmitter (24a).

Detailed Description Text (6):
The RF signal is decoded by the high-frequency receiver and assimilated into a message which contains identification, gas and mileage information for the vehicle. The resulting message is sent to an interface module (25), preferably via an intermediate frequency link (not shown). The interface module (25) is designed in a conventional manner to decode the data from the intermediate frequency links, convert it from serial to parallel form and block it for readable message content. Specifically, the interface module (25) converts the serially received information from the high-frequency receiver (24) into a digital message which is provided to the local processor (11) via port (12). Upon receiving a message from the interface

module (25), the local processor (11) analyzes the message to determine if it is complete. If the message is incomplete or contains out-of-bounds information, the local processor (11) sends a signal to the low-frequency transmitter (19), causing it to re-interrogate the vehicle (17) in order to receive a complete and correct message.

Detailed Description Text (8):
When the vehicle (17) enters the station (10), gate and signal controllers (26) and (27) respond to the local processor (11) by indicating to the operator of the vehicle that he/she should wait for the interrogation process to be completed. Upon successful completion of the interrogation process, the local processor (11) instructs the gate and signal controllers (26) and (27) to permit the vehicle to leave the station.

Detailed Description Text (9):
In the event that the main computer (32) analyzes the message provided from the local processor (11) and determines that the message is incorrect or incomplete, a message is sent from the main computer to the local processor requesting the latter to re-interrogate the vehicle (17). In such a situation, the local processor will not issue an acknowledgment signal to the gate controller (26) and signal controller (27) until it has received an acknowledgment message from the main computer (32). In an alternative embodiment of the invention, the local processor (11) makes the determination as to whether or not the message is complete and correct and thereby directly controls the gate and signal controllers (26) and (27) without waiting for an acknowledgement from the main computer.

Detailed Description Text (10):
It is contemplated that the local processor (11) be provided with a number of local keyboards such as local keyboards (30) and (31) in the illustrated embodiment. The local keyboards (30) and (31) may be used, for example, to send messages to the local processor (11) requesting tasks for the local processor to complete, such as the re-interrogation of a vehicle. The local keyboard may also be used for sending messages to the main computer (34) which supplement the information downloaded from the vehicle (17). Such a supplementary message contains, for example, information which is gathered from a visual inspection of the vehicle (17) at the station (10). Such messages are expected to be in the form of comments or notes regarding the condition of the vehicle (17). Furthermore, the local keyboards (30) and (31) may function to control the gate or signal controllers (26) and (27) for any one of the stations (10), (12) and (13).

Detailed Description Text (11):
To implement the control circuit (23) of FIG. 1, a small micro-controlled subsystem shown in FIG. 2 is provided on-board each vehicle for use in conjunction with the larger system of the invention. A micro-controller (184) running instructions from a ROM (185) controls the operation of the vehicle unit. The micro-controller (184) essentially operates as a sequencer responsive to externally received interrogation and programming signals. An example of a suitable device incorporating many of the elements in FIG. 2 is an 800 Series control oriented processor (COP) manufactured by National Semiconductor which includes an 8 channel A/D converter, a 1K-byte ROM memory, a 64-byte RAM memory and a microcontroller. Vehicle information which is supplied via an analog signal is supplied to an analog-to-digital converter (180). Analog vehicle parameters include, for example, information from the fluid level, oil pressure and water and fuel level sensors of FIG. 1. The analog-to-digital converter (180) works on a serial basis and provides the information from the various sensors to either a memory bank (182) or directly to the micro-controller (184) via a serial input/output port (181), depending on instructions from the micro-controller (184). An input register (183) is provided as an input to the micro-controller (184) for various digital sensor information, such as information from the mileage sensor (22) and the keypad. The micro-controller (184) also controls an output register (186) which enables and/or disables each of the analog-

to-digital converter (180), the memory bank (182), and the input register (183) via respective chip select inputs (CS) which are provided by the output register (185). The micro-controller (184) also controls communication to and from the vehicle via a transmitter/receiver input/output port (187). Attached to the input/output port (187) is the low-frequency receiver (20) (FIG. 1) which is enabled or disabled by the micro-controller (184) via an enable line from the input/output port (187). The low-frequency receiver antenna (188) is connected to the low-frequency receiver (20) and supplies signals received from the low-frequency transmitter (19) (FIG. 1). Signals from the transmitter (19) received by the low-frequency receiver (20) are demodulated and decoded via a pulse detector (190) which supplies low-frequency digital information to the input/output port (187) in a serial manner.

Detailed Description Text (12):
Also attached to the input/output port (187) is the high-frequency transmitter (24a). Information which is transmitted from the micro-controller (184) through the input/output port (187) is supplied to the high-frequency transmitter (24a) via a high-frequency modulator (191) which converts the received digital information into a high-frequency analog signal. Similar to the low-frequency receiver (20), the high-frequency transmitter (24a) is enabled or disabled by the micro-controller (184) via an enable line from the input/output port (187). Connected to the high-frequency transmitter (24) is a high-frequency antenna (193) for transmitting high-frequency information from the vehicle (17) via high-frequency RF signals to the high-frequency receiver (24) which is ultimately connected to the local processor (11) as explained in connection with FIG. 1.

Detailed Description Text (13):
In keeping with the invention, data collected by the control circuit (23) is downloaded to the local processor (11) and delivered to the main computer (32) where it is entered into conventional data streams used by commercially available billing programs for generating a statement of account (32a). In commercially available automatic billing systems used for example by the vehicle rental industry, information such as mileage and fuel level is manually entered into the data stream via a keyboard input. The invention eliminates any need for the manual inputting of data so that the vehicle operator need not be held up by manual processing of information when he steps up to the front desk of an agency in order to close the rental transaction. Because of the automatic entry of the necessary vehicle parameters into the data stream of the billing program, a statement of account (32a) will normally be ready for the customers' review and acceptance when he reaches the transaction counter. Sensor data downloaded from the vehicle (17) is also made available to the main host computer (32) for listing the service needs of the vehicle and updating any historical database kept by the main computer for service records. In this regard, the service record (32b) may be prepared by commercially available routines that typically accept data from a keyboard input. In accordance with the invention, at least part of the service information provided to the service record routine is derived from the data link between the local processor (11) and the main computer (32). In a car rental environment, the service record (32b) provides an attendant with information regarding what servicing of a particular vehicle is needed before the vehicle is returned to the rental fleet. For example, the vehicle may require refueling or the refilling of the windshield fluid reservoir. Additionally, total mileage can be checked against a bench mark mileage recorded in a memory of the main host computer (32) for the purpose of scheduling periodic maintenance such as engine tune-ups and the like.

Detailed Description Text (14):
In an alternative application of the system of the invention, car repair businesses may utilize the system to compliment commercially available billing programs so as to automate recordation of requested repairs and the preparation of a statement of account for parts and services rendered. From a hardware basis, the invention is identical for either car rental or car repair applications. In this regard, the software of the invention as set forth in FIGS. 4-13 is also identical. However, by

running different commercially available programs, the system serves to realize automation of either vehicle rental or car repair businesses.

Detailed Description Text (15):
Applicants expect that a keypad (35) mounted in the dashboard area of the vehicle (17) may usefully complement the basic sensor inputs to the control circuit (23) in a vehicle repair environment of the invention. As indicated in FIG. 3, such a keypad (35) may include a plurality of keys (36), each indicative of a particular repair or service need of the vehicle. As the operator of the vehicle becomes aware of repair or service needs not detectable by any sensors on-board the vehicle, a keystroke to the appropriate key (36) will enter data into a memory contained in the control circuit (23). Such data will at a later time be automatically downloaded when the vehicle is driven into the service area. For example, simple service requests such as cleaning the interior and exterior can be data entries provided by keystrokes as indicated by the exemplary keypad (35) of FIG. 3.

Detailed Description Text (16):
Virtually any repair or service required can be automated by way of additional keys on the keypad (35). For example, a keystroke to key (37) of the keypad (35) in FIG. 3 will provide a service report of a symptom requiring service to the vehicle--i.e., the engine runs rough. A keystroke to key (38) in the keypad (35) of FIG. 3 will indicate to the mechanic inspecting the automated service record that the climate control system is malfunctioning.

Detailed Description Text (18):
Applicants note that the addition of the keypad to the system on-board the vehicle (17) is less likely to be successful in a car rental environment than in a vehicle repair environment since charges for repairs requested via the keypad may not necessarily be chargeable back to the customer. Therefore use of a keypad in a rental environment is susceptible to false entry of data. Because a customer will be charged for repairs resulting from keystrokes to the keypad in a car repair business, the integrity of the data entered into the keypad is likely to be much greater.

Detailed Description Text (20):
Turning to the flow diagrams and refering first to FIG. 4, there is shown a functional flow diagram of the routine executed by the low-frequency transmitter. An essential requirement for the operation of a low-frequency transmitter (19) is the presence of the vehicle within the site as sensed by the annunciator. Thus, the first step of the low frequency transmitter routine, step 40, is to check if the annunciator (18) is closed thereby indicating the presence of the vehicle (17) within the area of the station (10). If the annunciator (18) is not closed, thereby indicating that the vehicle (17) is not present within the station area, the low-frequency transmitter (19) is not activated and the routine branches to its end.

Detailed Description Text (21):
In the event that the annunciator (18) is closed, thereby indicating the presence of the vehicle (17) within the area of the station (10), the routine branches to step 41. In step 41, the low-frequency transmitter (19) determines whether a programming or an interrogation signal is requested from a control signal provided from the local processor (11). If it is determined that an interrogation signal is requested, then the routine branches to step 42, where a low-frequency signal with a 50% duty cycle is transmitted in the direction of the vehicle (17) for a period of five seconds. Such a transmission constitutes an interrogation signal, and when completed, the routine of the low-frequency transmitter (19) is finished.

Detailed Description Text (22):
In the event that the low-frequency transmitter (19) determines in step 41 that a programming signal rather than an interrogation signal is requested by the local processor (11), the routine branches to step 43 where a low-frequency signal with a

75% duty cycle is transmitted for a period of five seconds. Transmission of such a tone initiates a programming mode in that the tone is recognized by the low-frequency receiver located on the car. After the tone for initiating the programming mode is transmitted, the routine branches to step 44 where a synchronizing signal is transmitted to the vehicle (17). Next, in step 45, the low-frequency transmitter (19) waits for a signal from the local processor (11) indicating that an identification signal has been received from the vehicle (17) within the station (10). After the local processor (11) has received the identification signal, the routine continues to step 46 in which a synchronizing signal is transmitted in the direction of the vehicle (17). Next, in step 47, a programming sequence is transmitted in the direction of the vehicle (17) by the low-frequency transmitter (19). Such a programming sequence contains, for example, commands or instructions for the vehicle such as the resetting indicators (e.g., trip mileage meter) or storing data in a memory device located on the vehicle for later access (e.g., a service record).

Detailed Description Text (23):
After the transmission of the programming sequence the routine branches to step 48 wherein the vehicle (17) acknowledges the safe receipt of the programming sequence. In the event that a complete programming sequence is not timely received by the vehicle (17) after a programming sequence synchronizing signal is sent in step 46, the vehicle will not transmit a vehicle identification signal, and thus, the routine will branch back to step 46 and re-transmit a synchronizing signal in step 46 and the programming sequence in step 47. Re-transmission of the synchronizing signal and the programming sequence will continue until a valid vehicle identification signal is received, indicating that the programming sequence has been successfully received by the vehicle and the routine of the low-frequency transmitter (19) is completed.

Detailed Description Text (24):
Referring to FIG. 5, there is shown the routine for execution by the low-frequency receiver (20) and/or the micro-controller (185) located on board the vehicle (17). Beginning in step 55, it is determined whether the on-board unit is powered by its own battery or by the battery of the vehicle (12). If the unit is powered by the battery of the vehicle (17), it is always on as indicated by step 56. If the on-board unit is powered by its own battery, the procedure branches to step 57 where the receiver pauses for approximately 4.5 seconds as part of an energy-saving subroutine. Next, in step 58, the receiver (20) turns on for approximately one-half second and then branches to step 59 where it determines whether a tone has been received. If a tone has not been received, the routine of the receiver (20) branches back to step 55, completing an energy conserving loop which is continuously executed by the receiver (20). Since an interrogation or a programming signal from the low frequency transmitter is transmitted for a duration of five seconds, a pause for 4.5 seconds in step 57 combined with enabling the receiver (20) for 0.5 seconds allows for a sufficient window of "on time" for the receiver (20) that the five second transmission from the low-frequency transmitter (19) will be detected by the low-frequency receiver (20).

Detailed Description Text (25):
If a tone is received by the low-frequency receiver (20), the routine branches to step 60 where it determines whether or not an interrogation tone has been received. If an interrogation tone has been received, the routine branches to step 61 where a subroutine for transmitting the vehicle identification signal is called, and vehicle identification and operating parameter information are transmitted by the high-frequency transmitter (24a) and the routine loops back to step 55. Otherwise, in step 60 if it is determined that the tone received was not an interrogation tone, the routine branches to step 62 where it determines whether the tone is a programming tone. If the tone is not a programming tone, execution of the routine branches back to step 55. If it is determined that the tone is a programming tone, execution of the routine branches to step 63 where the subroutine for transmitting

the vehicle identification signal is called and vehicle identification and operating parameter information is transmitted via the high-frequency transmitter (24). In step 64, a programming mode subroutine is called for the low-frequency receiver (20). After a complete programming sequence is received by the low-frequency receiver (20) of the vehicle (17), the instruction or commands encoded therein are carried out by the processor (23) on-board the vehicle. Such instructions are contemplated as involving the storage or modification of particular values or information in a an on-board digital memory device. After the program mode subroutine is completed, the main routine for the receiver (20) branches back to step 55 and continues looping, looking for a tone from the low-frequency transmitter (19) associated with the annunciator (18).

Detailed Description Text (26):
A routine executed by the high-frequency transmitter (24a) and/or the micro-controller (184) on-board the vehicle (17) is initiated in response to an interrogation request from the low-frequency transmitter (19) and detected by the low-frequency receiver (20) on-board the vehicle (17). This routine is responsible for transmitting vehicle identification and operating parameter information via the high-frequency transmitter (24a) located on the vehicle (17). The routine begins in step 70 of FIG. 6 by transmitting an initial synchronizing signal to prepare the high-frequency receiver (14) for receipt of a message.

Detailed Description Text (27):
In the illustrated embodiment of the invention, the synchronizing signal is comprised of a 49 mega-hertz carrier which is modulated by a 500 to 1000 hertz signal with a 50% duty cycle. After the synchronizing signal is sent, the routine branches to step 71 in which the vehicle identification signal is transmitted. Using a pulse-width modulation technique, digital information relating to the vehicle identification signal is transmitted in a serial format via the high-frequency transmitter (24a) on-board the vehicle (17). Using this technique, digital ones are represented by a modulated signal with a 75% duty cycle, and digital zeros are represented by a modulated signal with a 25% duty cycle. Using this technique the vehicle parameter information is also transmitted beginning with step 72 wherein it is determined whether the gas sensor (21a) is installed on the vehicle (17) and attached to the high-frequency transmitter (24a) so as to allow the reading and downloading of the amount of gasoline in the vehicle. If it is determined in step 72, that the gas sensor (21a) is present, the routine branches to step 73 wherein the gas level is read from the gas sensor (21a) and it is sent via the high-frequency transmitter (24a).

Detailed Description Text (28):
If it is determined in step 72 that the gas sensor (21a) is not present, the routine branches to step 74 wherein it is determined whether the mileage sensor (21b) is present on the vehicle (17)). If the mileage sensor (21b) is present, the routine branches to step 75 where the mileage information is read from the mileage sensor and it is downloaded to the high-frequency receiver (24) via the high-frequency transmitter (24a). If the mileage sensor (21b) is not present on the vehicle (17) the routine branches directly to step 76 where it is determined whether a key pad device (see FIG. 3) is installed in the vehicle (17) and whether it is connected as an input to the high-frequency transmitter (24a). If a key pad device (21e) is connected, the routine branches to step 77 and the information entered from the key pad is read and sent via the high-frequency transmitter (24a). If the keypad device (21e) is not connected, the routine branches directly to step 78 wherein it is determined whether a washer fluid sensor (21c) is present on the vehicle (17). If a windshield washer fluid level sensor (21c) is present on the vehicle (17), the routine branches to step 79 wherein information from the windshield washer fluid sensor is read and downloaded via the high-frequency transmitter (24a).

Detailed Description Text (29):

In a similar manner as set forth for the foregoing sensors, information from a whole variety of various sensors, any of which may be installed on the vehicle (17), may be downloaded to the local processor (11) in the message containing operating parameter information. These various additional operating parameters may be derived from conventional sensors and provide information regarding oil transmission and radiator fluid level and the state of the battery and the electrical fuses. The routine checks to determine which of these sensors is present, and reads the information presented by the sensors and downloads it as operating parameter information. It will be apparent that any number of additional or different sensor devices beyond those mentioned here may provide various other operating parameter information in the download message.

Detailed Description Text (34):
The local processor (11) is at the heart of the present invention, providing control and processing functions which are vital to the gathering of vehicle information and processing it to provide maintenance and transaction information. Among the functions provided by the local processor (11) are the receipt of information from the interface module (25), the transmission of information to and from the main host computer (32), the servicing of the local keyboards (30) and (31) and the servicing of various internal processes. In order to provide all these functions, the local processor (11) runs a real time multi-tasking scheduler routine which organizes, processes view and controls the servicing of various routines executed by the local processor. The real-time scheduler routine run by the local processor (11) is shown in FIG. 8 and begins at step 100 when the local processor is reset when it is first turned on. Resetting initializes all input/output (I/O) channels and peripheral devices of the processor in addition to setting and activating various interrupt vectors as is generally known in software programming.

Detailed Description Text (35):
By using a number of status flags, the local processor (11) determines which devices are requesting service. For example, when the main host computer (32) has information which it wishes to send to the local processor (11), a status is set. Similarly, a status flag is used to indicate to the local processor (11) when one of the local keyboards (30), (31) has information which it wishes to transmit to the local processor. In step 101, the local processor checks to see which ones of the flags, if any, have been set to indicate a request of service. In step 102, if it is determined from the status of the various flags that no service routine has been requested, the routine branches back to step 101 to check the status flags again. Otherwise, if any service routines have been requested in step 102, then the routine branches to step 103 in which a 100 millisecond interrupt timer is started. A 100 millisecond interrupt timer is used to limit the amount of time which will be spent in one service routine, so as to prevent the system from being infinitely delayed in the event a fault occurs while a routine is being executed. Additionally, the 100 millisecond interrupt timer insures that a request for a different service routine will not go unnoticed for more than 100 milliseconds. Such a feature is very important in the context of a service routine for the interface module (25), which involves information that is currently being received from the automobile and will only be available for a finite amount of time. Thus, the interrupt timer insures that the information from the interface module (25) is read before new information is written over the old and lost.

Detailed Description Text (38):
After the number of the interface modules is set, the routine first branches to step 118 where a character is read from the selected module and then branches to step 119 where the character is placed in a memory buffer in the local processor (11). The memory buffer is partitioned such that there is an area dedicated to each of the interface modules attached to the local processor (11) through the input ports (12), (15) and (16). The memory buffer serves as temporary storage for messages which are being received from a particular interface module.

Detailed Description Text (39):
After the character has been read from the selected interface module and placed in its associated area of the memory buffer, the routine continues to step 120 where it is determined whether the received character has completed the message. If the last received character does not complete the message, the routine branches back to the beginning at step 115 where the interface module is checked to see if any additional data is ready.

Detailed Description Text (40):
If the last character received in step 120 completes the message, the routine branches to step 121 where the massage format is checked. This check involves determinations such as whether the message length is correct and whether the various values contained within a message are within the predetermined acceptable range. For example, values indicating a negative fuel level will determine that the message is incorrectly formatted. Similarly, a vehicle identification number which does not contain a sufficient number of characters indicates that the message is incorrect.

Detailed Description Text (43):
If it is determined in step 130 that data is available from the local keyboard, the routine branches to step 132 where a character is read from the keyboard by the local processor (11). After the character has been read, the routine continues to step 133 where it is determined whether the received character forms a command. This determination is based in part upon the type and number of previously received characters which may comprise the beginning portion of a command. If in step 133 it is determined that the received character is not a command, (e.g., not enough characters have been received to complete a command), the routine branches back to the beginning and checks again to see if more data is available from the local keyboards (30) or (31). If, in step 133 the received character forms a command, the routine branches to step 134 where it is determined whether the command is valid. This determination is made by comparing the received command with a predetermined list of valid commands stored in memory at the local processor (11).

Detailed Description Text (51):
In addition to the various routines which interface and establish communication sessions with the local processor, a number of internal routines may be run on the local processor (11) on a timeshared basis with the other routines. As generally known in the art, internal processes may involve, for example, the copying of a message from a message buffer to the transmit buffer, assembling and disassembling messages and their component parts from formats in which the messages are received to formats in which the messages are expected to be transmitted, and running various general housekeeping or diagnostic procedures within the local processor (11) itself. The internal process routine of FIG. 13 is executed by the local processor (11) for the purpose of scheduling the internal routines. It may also be responsible for converting the messages from one format to another, which would include deleting, appending or otherwise modifying header and trailer information attached to the messages and inserting or removing various error correcting and/or detecting information possibly included in various stages of communication of the messages.

Detailed Description Text (54):
From the foregoing it will be appreciated that a novel system is disclosed for automating vehicle-related transactions such as rental and repair businesses. By providing a system which automatically retrieves information from a vehicle and prepares a statement of account and a service request therefrom, simple transactions can be accomplished in an efficient manner, eliminating customer waiting and associated aggravation.

Current US Cross Reference Classification (3):

701/35

CLAIMS:

1. At a site for processing vehicles, a system for automatically identifying vehicles, assimilating data from an identified vehicle, correlating said data with predetermined data and providing a hard copy indicative of a transaction between an operator of the vehicle and another party, said system comprising in combination:

an annunciator for automatically detecting the presence of a vehicle at said site;

radio frequency transmitter means at said site responsive to said annunciator for transmitting an interrogation signal to said vehicle;

means on-board said vehicle for sensing data indicative of operation conditions of said vehicle and a memory containing data identifying said vehicle;

radio frequency transmitter and receiver means on-board said vehicle;

said means on-board said vehicle being responsive to said interrogation signal detected by said transmitter and receiver means for downloading via said transmitter and receiver means said vehicle identification data and said sensed data to processor means within said site;

said processor means including means for receiving said downloaded data from said vehicle; and

means associated with said processor means for correlating said downloaded data with predetermined other data and providing printouts to a worker indicative of 1) a transaction between an operator of said vehicle and another party and 2) service requirements of said vehicle.

2. A system as set forth in claim 1 wherein said on-board means includes sensors for automatically recording data for the mileage of said vehicle and the relative amount of gasoline in a tank of said vehicle, said on-board means also including means for creating a data stream for downloading said identifying data and said mileage and gasoline data to said processor means via said transmitter and receiver means.

3. A system as set forth in claim 1, including

storage means associated with said processor means containing information regarding a service record of said vehicle; and

said processor means including means for updating said service record with information contained in said accumulated data.

6. A system as set forth in claim 1 including a keypad mounted within a passenger compartment of said vehicle and coupled to said on-board means, said on-board means being responsive to keystrokes to said keypad for recording service data entered by an operator of said vehicle.

10. At a site for servicing vehicles, a system for automatically providing information regarding service required of each vehicle entering said site, said system comprising:

an annunciator for automatically detecting the presence of a vehicle at said site;

a radio frequency transmitter at said site responsive to said annunciator for transmitting an interrogation signal to said vehicle;

sensors on-board said vehicle for providing signal indicative of the status of serviceable devices on said vehicle;

first processor means on-board said vehicle responsive to said sensed signals for generating data indicative of the status of said serviceable devices and combining said data with additional data containing information identifying said vehicle so as to form a data stream when said interrogation signal is transmitted;

means on-board said vehicle coupled to said processor means for downloading said data stream by a radio frequency signal;

second processor means at said site responsive to said data stream downloaded by said on-board means;

storage means associated with said second processor means containing information regarding a service record;

said second processor means including means for updating said service record with information contained in said data stream; and

means responsive to said second processor means for transforming said data stream into visual service information for use in performing maintenance on said vehicle.

11. A system as set forth in claim 10 including a keypad mounted within a passenger compartment of said vehicle and coupled to said first processor means, said first processor means being responsive to keystrokes to said keypad for recording service data entered by an operator of said vehicle.

13. A method of automatically gathering identification and operating parameters from a vehicle at a predetermined site, said method comprising the steps of:

(a) automatically sensing the presence of a vehicle at said site;

(b) transmitting a radio frequency interrogation signal to said vehicle;

(c) receiving said interrogation signal by said vehicle and in response thereto:

(1) gathering information relating to said operating parameters of said vehicle;

(2) transmitting from said vehicle said information relating to said operating parameters of said vehicle and vehicle identification data as a radio frequency signal;

(d) receiving from said vehicle said information relating to said operating parameters of said vehicle;

(e) processing said information received from said vehicle into a predetermined digital form;

(f) verifying said information received from said vehicle and in response thereto:

(1) repeating from step (b) if said verification indicates said information received from said vehicle is not correct; or

(2) transmitting a signal to said site acknowledging receipt of said information from said vehicle if said verification indicates said information received from said vehicle is correct.